REMARKS

I. Amendments to the specification:

We propose to replace the abstract in accordance with the suggestion made by the Examiner.

Applicants propose to add the missing section headings in accordance with the current practice of the US Patent Office and in conformity with 37 CFR 1.77(b).

II. Claims Objections:

Claim 17 was objected because of informalities.

Applicants are of the opinion that this claim as amended herewith is now in a proper form.

No new matter has been added by way of these amendments.

For sake of clarity, amendments to the claims are reflected in the enclosed listing of claims.

III. Claims Rejections under 35 USC 102:

The Examiner rejected claims 13 to 24 under 35 USC 102(b) as being anticipated by Carlson (US 4,441,362). We respectfully disagree with the Examiner's reasoning that forms the basis of this rejection.

The present invention relates to a method for calculating the relative volumetric flow-rates of at least one of the phases of a multiphase effluent flowing in a well, the method comprising a first step of acquiring local volumetric fractions and/or velocities of the phases across a section of the well at a certain depth.

The method of the invention further comprises the following distinguishing steps. The local volumetric fraction and/or velocity measurements is/are corrected in order to make them consistent with each other and/or with the effluent flow conditions. Then, a suitable flow model mathematically representing the effluent flow is selected. Subsequently, the local volumetric fraction measurements and/or the local velocity measurements are interpolated by the selected flow model in order to obtain a volumetric fraction profile and/or a velocity profile for at least

one phase of the effluent across the section of the well at the depth. Finally, the relative volumetric flow-rates of the at least one phase are calculated by integration of the volumetric fraction and/or velocity profiles over the section of the well at the depth.

Carlson describes an apparatus and a method for determining volumetric fractions and flow rates of individual phases within a multi-phase flow regime. The method comprises the steps of measuring the density of the fluid flow regime, and measuring dielectric response characteristics of the fluid flow regime. Then, a functional relationship is established between the dielectric response characteristics measurement and the volumetric fraction of at least one phase of the fluid flow regime. The functional relationship is established in reference to the measured density of the fluid flow regime. More precisely, the step of establishing the functional relationship comprises a plurality of steps. Firstly, the functional relationships between measured dielectric response characteristics of a fluid consisting of multiple fluid phases and the volumetric fractions of the fluid represented by at least one of the phases thereof is established as a reference. Then, the volumetric fraction of the fluid flow regime represented by at least one phase of the fluid flow regime in response to the density measurement is determined. Finally, the reference is adjusted in response to the volumetric fraction determination. Carlson further teach an apparatus for implementing the method. The apparatus is a density/capacitance/flowmeter logging instrument. The apparatus also comprises a specific collector aiming at blending the multi-phase mixture into a uniform mixture.

The description hereinbefore demonstrates that the present invention and the teaching of Carlson differ in at least four aspects.

The Examiner' statement that the Carlson's teaching in paragraph col. 11 lines 45-52 anticipate the correction step of the present invention is incorrect. Indeed, as explained by Carlson, the expression referenced as equation (1) indicates the functional relation of the measured mixture density at each depth measurement location to the volumetric fraction of water at that location. Some of the terms, namely the density of oil and water ρ_o and ρ_w are determined by fluid samples taken at the surface of the well. These measurements at the surface must be correlated to the downhole survey condition. Alternatively, the downhole measured mixture

density, namely ρ_m, must be converted. Therefore, the "correlation" or "conversion" step of Carlson does not consist in correcting the local volumetric fraction and/or velocity measurements in order to make them consistent with each other and/or with the effluent flow conditions as explained page 5 line 22 to page 10 line 7 of the present application (i.e. correction of the systematic measurement errors due to measurement means). Consequently, Carlson does not anticipate the correction step of the present invention.

The Examiner' statement that equation (1) mentioned col. 11 line 40 is identical to the selection step of the present invention is incorrect. Indeed, as explained by Carlson, equation (1) estimates the volumetric fraction of water. Hence, this estimation step does not consist in selecting a suitable flow model mathematically representing the effluent flow as explained page 10 line 8 to page 12 line 10 of the present application. Consequently, Carlson does not anticipate the selection step of the present invention.

The Examiner' statement that the volumetric fraction of water H_w, the volumetric fraction of oil H_o and their determination based on the equations (1) and (2) as explained by Carlson in col. 11 lines 35-55 is identical to the interpolation step of the present invention is incorrect. Indeed, the H_w and H_o determination steps of Carlson do not involve the selected flow model (in the meaning of the hereinbefore mentioned selection step). It is to be further emphasized that Carlson is silent about the use of the flow model (the velocity profile or any other profile characterizing the flow properties) when determining H_w and H_o. Consequently, Carlson does not anticipate the interpolation step.

The Examiner' statement that the calculation steps of equations (10) and (11) as explained by Carlson in col. 15 lines 43-47 are identical to the calculation step of the present invention is incorrect. Indeed, one skilled in the art can easily understand that calculating the flow rate of each individual phase (water and oil) by multiplying the determined volumetric fraction of water H_w and the determined volumetric fraction of oil H_o with the total measured flow rates expressed in barrels per day (BPD_T) at any depth location is a calculation that is different from the calculation as claimed consisting in integrating the volumetric fraction and/or velocity profiles over the section of the well at a certain depth. Consequently, Carlson does not anticipate the calculation step as claimed.

Consequently, the method and apparatus of the prior art does not describe or suggest the hereinbefore mentioned distinguishing features of the present invention. As a conclusion, amended claim 13 which incorporates these distinguishing features is clearly novel over the teachings of Carlson.

Further, Carlson does not enable taking into account the flow conditions that can modify or distort the local measurements (see page 3 of the present invention). Indeed, Carlson does not teach or suggest how to calculate the volumetric flow rates of the phases of a multiphase effluent flowing in a well taking into account the flow conditions. Therefore, a skilled person considering the teaching of Carlson would not obviously derive the present invention as claimed in amended claim 13. Consequently, amended claim 13 which incorporates the hereinbefore mentioned distinguishing features is inventive.

In conclusion, the amended claims define a solution that differs substantially and fundamentally from the solution that Carlson proposes. Consequently, the claims are novel and inventive with respect to Carlson.

As a conclusion, amended claim 13 is allowable over the prior art and dependent claims 14-24 are also allowable for at least the same reasons.

CONCLUSION

Applicant is of the opinion that this reply is fully responsive to all outstanding issues. Accordingly, the application is now deemed to be in condition for allowance, and notice to that effect is solicited.

This paper is submitted in response to the Office Action mailed 17 January 2006 for which the three-month date for response is 17 April 2006. Please apply any charges not covered, or any credits, to Deposit Account 50-2183 (Reference Number 21.1100).

Date: 13-Apr-06

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